

# Balloon-Borne Cryogenic Telescope Testbed (BOBCAT)

Completed Technology Project (2017 - 2021)



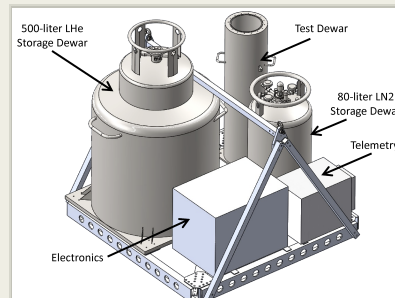
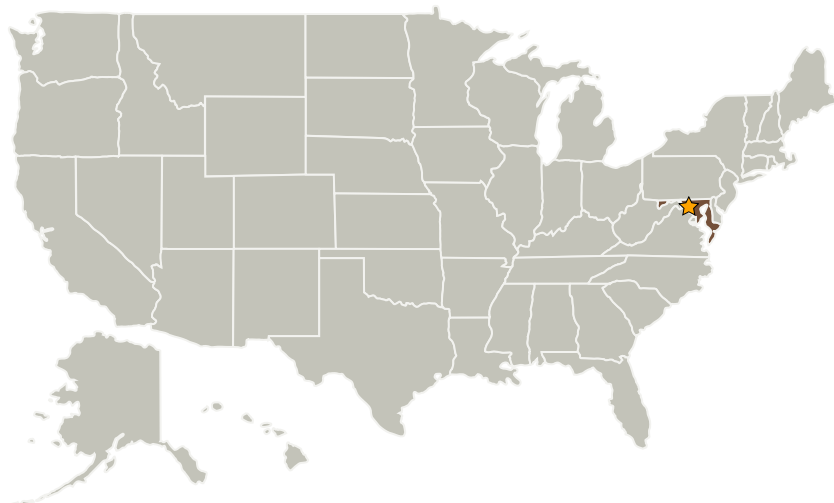
## Project Introduction

The Balloon-Borne Cryogenic Telescope Testbed (BOBCAT) is a technology demonstration to develop advanced instrumentation for astrophysical observations at far-infrared wavelengths. It develops cryogenic techniques as an enabling technology to improve far-IR sensitivity by a factor of 100,000 or more compared to current state-of-the-art instrumentation such as SOFIA. Cryogenic spectrometers, operating at balloon altitudes, have game-changing capabilities, but achieving this goal while remaining within balloon payload mass limits requires ultra-light cryostats. This project develops the ultra-light cryostat and demonstrates the ability to transfer cryogenic liquids at balloon altitudes.

## Anticipated Benefits

BOBCAT develops a new class of far-IR payload with breakthrough scientific capability. The science case is compelling. Far-IR emission lines probe the chemical content, energetics, and physical conditions within the interstellar medium of the Milky Way. Atomic and ionic fine structure lines (CII, NII, OI, OIV) dominate the far-IR spectrum of both normal and star-forming galaxies and can trace star formation activity across cosmic time. The proposed platform takes advantage of the unique physical conditions at balloon altitudes to improve far-IR mapping speed by five orders of magnitude compared to SOFIA, allowing observations in a single night that would otherwise require 2000 years.

## Primary U.S. Work Locations and Key Partners



Schematic of BOBCAT payload

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| Organizations Performing Work      | Role              | Type        | Location            |
|------------------------------------|-------------------|-------------|---------------------|
| ★Goddard Space Flight Center(GSFC) | Lead Organization | NASA Center | Greenbelt, Maryland |

## Primary U.S. Work Locations

Maryland

## Project Transitions

▶ **October 2017:** Project Start

✔ **September 2021:** Closed out

**Closeout Summary:** This project successfully demonstrated the ability to transfer cryogenic liquids (liquid nitrogen and liquid helium cryogenic) from a stratospheric payload at altitude 35 km. This is a necessary first step for a new generation of large cryogenic observatories at mid- to far-infrared wavelengths. The purpose of the Goddard Space Flight Center's Internal Research and Development (IRAD) program is to support new technology development and to address scientific challenges. Each year, Principal Investigators (PIs) submit IRAD proposals and compete for funding for their development projects. Goddard's IRAD program supports eight Lines of Business: Astrophysics; Communications and Navigation; Cross-Cutting Technology and Capabilities; Earth Science; Heliophysics; Planetary Science; Science Small Satellites Technology; and Suborbital Platforms and Range Services. Task progress is evaluated twice a year at the Mid-term IRAD review and the end of the year. When the funding period has ended, the PIs compete again for IRAD funding or seek new sources of development and research funding, or agree to external partnerships and collaborations. In some cases, when the development work has reached the appropriate Technology Readiness Level (TRL) level, the product is integrated into an actual NASA mission or used to support other government agencies. The technology may also be licensed out to the industry. The completion of a project does not necessarily indicate that the development work has stopped. The work could potentially continue in the future as a follow-on IRAD; or be used in collaboration or partnership with Academia, Industry, and other Government Agencies. If you are interested in partnering with NASA, see the TechPort Partnerships documentation available on the TechPort Help tab. <http://techport.nasa.gov/help>

## Organizational Responsibility

## Responsible Mission Directorate:

Mission Support Directorate (MSD)

## Lead Center / Facility:

Goddard Space Flight Center (GSFC)

## Responsible Program:

Center Independent Research &amp; Development: GSFC IRAD

## Project Management

## Program Manager:

Peter M Hughes

## Project Managers:

Keith M Jahoda  
David H Richardson

## Principal Investigator:

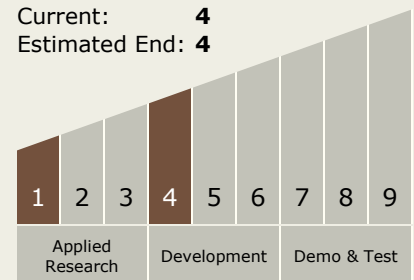
Alan J Kogut

## Technology Maturity (TRL)

Start: 1

Current: 4

Estimated End: 4

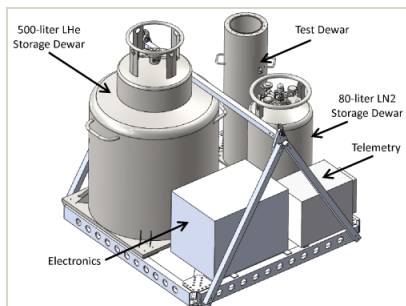


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## Images



### Schematic of BOBCAT payload

Schematic of BOBCAT payload  
(<https://techport.nasa.gov/image/102490>)

## Links

NASA Goddard Facebook  
(<https://www.facebook.com/NASA.GSFC>)

NASA Goddard Science and Exploration Directorate  
(<http://sciences.gsfc.nasa.gov/sed/>)

NASA Goddard Twitter  
([https://twitter.com/intent/follow?screen\\_name=NASAGoddard](https://twitter.com/intent/follow?screen_name=NASAGoddard))

### Project Website:

<http://www.nasa.gov/centers/goddard/home/index.html>

## Technology Areas

### Primary:

- TX08 Sensors and Instruments
  - └ TX08.1 Remote Sensing Instruments/Sensors
  - └ TX08.1.4 Microwave, Millimeter-, and Submillimeter-Waves

## Target Destination

Outside the Solar System

## Supported Mission Type

Projected Mission (Pull)